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CRITERIA FOR HYDRAULIC DESIGN OF GROYNE WALLS (CURVED WING) FOR SEDIMENT DISTRIBUTION AT OFFTAKE POINTS IN A CANAL

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CRITERIA FOR HYDRAULIC DESIGN OF GROYNE WALLS (CURVED WING) FOR SEDIMENT DISTRIBUTION AT OFFTAKE POINTS IN A CANAL

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CRITERIA FOR HYDRAULIC DESIGN OF GROYNE WALLS (CURVED WING) FOR SEDIMENT DISTRIBUTION AT OFFTAKE POINTS IN A CANAL

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 November 1975, after the draft finalized by the Canals and Canal Linings Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Sediment movement plays significant role in the design of a canal. Its consideration is essential for evolving satisfactory design. At canal offtakes, measures for checking sediment entry or for removing the same that has entered in the canal in excess of its transport capacity are resorted to whereas at branch of distributory offtakes, the proportionate distribution of sediment load in proportion to the discharges is a prime requisite for the regime of the bifurcating channels so that they result in neither silting nor scouring. This objective is well served with the help of groyne walls.

1. SCOPE

1.1 This standard covers criteria for the hydraulic design of groyne (curved wing) wall for sediment distribution in the offtaking canals.

2. GENERAL

2.1 In order to achieve that the distributory draws its share of sedim load a curved vertical wall extending from the downstream abutm of the offtaking channel into the parent channel may be provided shown in Fig. 1. If the offtaking channel has a mild slope than the parent channel, the curved wall may not be useful to the desired extent and has to be employed in combination with sediment vanes.

3. EXTENT OF PROJECTION

3.1 The curved wing shall project far enough (*see* **3.2**) into the parent channel to divert ample discharge and proportionate sediment into the offtaking channel under all working conditions.

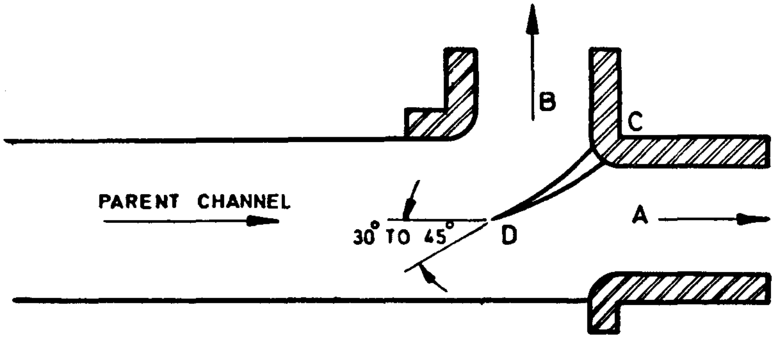


FIG. 1 CURVED WING WALL

3.2 The curved wing adjusted in conformity with the curvature of the streamlines bending from the parent channel to the offtake with nose inclined between 30 and 45° to the flow (Fig. 1) will be conducive to proportionate distribution of sediment and discharge in the offtaking channel. The curved wing shall extend at least up to 3/4 of the width of the offtake. However, it is preferable to take the wall up to the point opposite of the upstream abutment of the offtake. The distance of the nose from the upstream abutment of the offtake may be kept so as to divert adequate discharge into the offtake. The shape of the guide vane may be determined by joining the nose, aligned at 30 to 45° to the flow, to the downstream abutment of the offtake by a smooth curve.

3.3 Complete absence of acceleration of flow upstream of the bifurcation point is desirable but it is not easily obtainable owing to variation of velocity over the cross sections of the parent channel and change in the wetted perimeter at the bifurcation point. The best that can be done is to proportion the width of the opening so as to give the same mean velocity as obtaining in the parent channel. With this proportioning there will be minimum deviation from the steady flow conditions at the bifurcation point.

3.4 The crest of the offtaking channel is envisaged at the bed level of the parent channel.

4. SHAPE OF NOSE

4.1 The nose at the bifurcation of flow shall be pointed and vertical. The thickness shall increase in the shape of a cut water as sharp as possible.

5. HEIGHT OF WALL

5.1 The groyne wall or the curved wing shall be at least 30 cm above the full supply level in the parent channel.

6. COMBINATION WITH SEDIMENT VANES

6.1 If by virtue of its gradient, the offtaking channel does not possess the same sediment-carrying capacity as the parent channel the groyne wall or the curved wing would not be useful to the desired extent. In such cases sediment vanes may be more effective and for effective sediment, distribution vanes may be combined with the curved wing as shown in Fig. 2A.

6.2 The minimum radius of the vane should be 7·5 m. Larger the radius of the vane, greater is its efficiency. A radius of 12 m is satisfactory for short vanes in small and medium channels.

6.3 To reduce eddy formation due to curvature of vanes at their downstream end, the vanes may be kept straight retaining an angle of about 27° with the centre line of the parent channel (Fig. 2B).

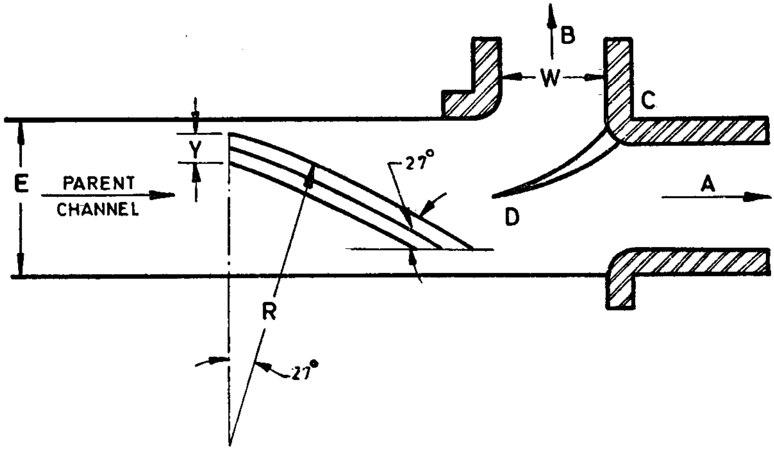
6.4 The height of vanes may be 1/4 of the depth of the parent channel. Spacing between the vanes should be about one and a half times the height of the vanes. The distances of vanes *X*, *Y* and *R* (Fig. 2B) may be fixed as detailed in Table 1.

6.5 In case the parent channel takes more sediment by virtue of its gradient, the vanes are applied in the reverse direction as shown in Fig. 3 with their height as envisaged in **6.4**.

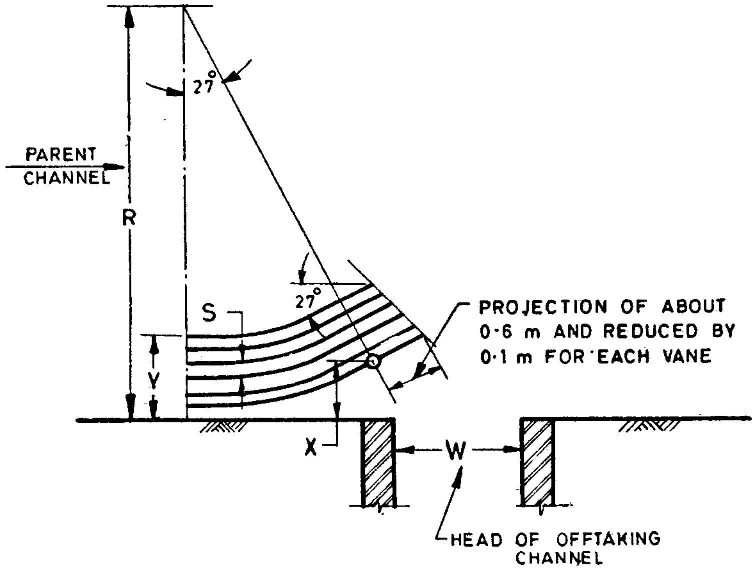
6.6 The bed of the parent channel covered by the vanes for a distance of 15 to 30 m upstream of the vanes shall be smoothly pitched. This will cause suspended sediment to drop as low as possible in the water by the time it reaches the vanes where it is diverted.

6.7 To minimize any tendency of sediment depositing on the pitched floor, it shall be built 15 centimetres higher than the normal silted bed of the parent channel. The edge of this floor and that of the portion on which the vanes are located shall be in one straight line parallel to the centre line of the parent channel. At least 5 metres of the pitching at the upstream end shall be at a slope of 1 in 10 so that the upstream edge is sufficiently below the silted bed and does not throw up sediment.

6.8 The side slope of the parent channel on the side of the offtake shall also be pitched in the same length upstream to which the bed pitching extends.



2A CURVED WING WALL WITH SEDIMENT VANE


27°
PARENT CHANNEL
R
27°
S
Y
PROJECTION OF ABOUT 0·6 m AND REDUCED BY 0·1 m FOR EACH VANE
X
W
HEAD OF OFFTAKING CHANNEL

2B CURVED VANES WITH STRAIGHT DOWNSTREAM ENDS FOR EDDY REDUCTION

FIG. 2 CURVED WING WALL

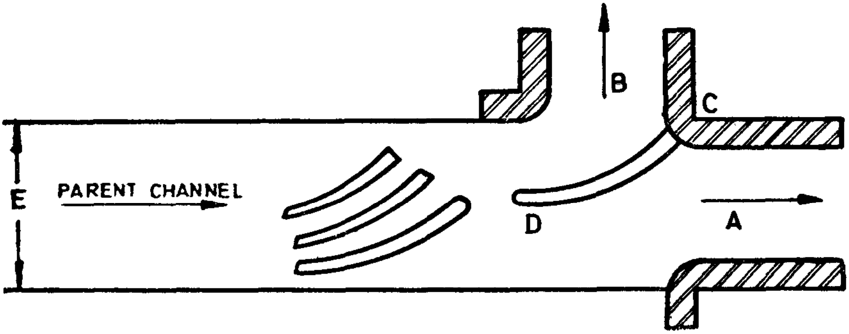


FIG. 3 CURVED WING WALL WITH REVERSED SEDIMENT VANE

TABLE 1 DIMENSIONS FOR SILT VANES IN METRES

(*Clause* 6.4)

		WIDTH OF OFFTAKING CHANNEL = W											
		0·609	1·219	1·828	2·438	3·048	3·657	4·876	6·096	7·620	9·144	12·192	15·240
For Strong Effect	Value of *X*	1·219	1·524	1·828	1·828	2·133	2·438	2·438	2·743	3·048	3·048	3·657	3·657
	Value of *Y*	0·609	0·914	1·219	1·524	1·828	2·438	2·743	3·353	3·962	4·572	6·096	7·620
	Value of *R*	9·144	10·668	12·192	12·192	13·716	13·716	15·240	15·240	15·240	16·764	19·812	30·480
Cheaper Design (Less Effect)	Value of *X*	0·914	1·219	1·219	1·524	1·524	1·828	1·828	1·828	1·828	1·828	2·743	2·743
	Value of *Y*	0·609	0·609	1·219	1·219	1·524	1·524	1·828	2·133	2·743	3·657	4·572	5·486
	Value of *R*	7·620	9·144	9·144	9·144	9·144	9·144	10·668	10·668	10·668	12·192	15·240	22·860
Minimum Dimensions Recommended	Value of *X*	0·914	0·914	1·219	1·219	1·524	1·524	1·828	1·828	1·828	1·828	1·828	1·828
	Value of *Y*	0·609	0·609	0·914	1·219	1·524	1·524	1·828	2·133	2·438	3·048	3·048	3·657
	Value of *R*	7·620	7·620	9·144	9·144	9·144	9·144	10·668	10·668	10·668	12·192	12·192	15·240

NOTE — The above figures are only intended as a rough guide and shall be changed according to the circumstances of each case. For example '*R*' should be greater for a large parent channel than for a small one. Also '*X*' and '*Y*' would ordinarily be made larger for a large and deep parent channel than for a small one.

In very bad case '*Y*' should be made greater than as shown in the strong effect columns above.

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